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SLD/SLO0625

Sunlight Readable

6.5” LED B/L LCD

User Manual

(1st Edition 2011/8/15)

All information is subject to change without notice.

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RECORD OF REVISION

Version and Date	Page	Old Description	New Description	Remark
Aug,15,2011	all		Preliminary Release	

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1.0 GENERAL DESCRIPTION

SLD/SLO0625 is a TFT LCD monitor, built-in 1000 nits high brightness for sunlight readable display. Features wide operating temperature, high brightness, AOT optical bonding, touch screen capable, and customized mechanical design; fulfill the demand for extreme environments. The high level of brightness together with LED backlight technology, the monitor brings remarkable display quality.Perfectly suitable for kiosk, ATM, POS, military, transportation, and outdoor industrial application.

1.1 FEATURES

- Sunlight Readable
- LED Backlight
- High Shock & Vibration Resistance
- Low Power Consumption
- Wide Temperature. Range
- High Uniformity
- Low EMI Noise
- Wide Dimming
- Life Expectancy

1.2 GENERAL SPECIFICATIONS

Model No.	SLD0625	SLO0625
Description	6.5" TFT LCD monitor, LED Backlight 1000 nits, VGA	
Backlight	LED Backlight	
Display Area (mm)	132.48 x 99.36 mm	
Brightness	1,000 cd/m^2	
Resolution	640 x480 (VGA)	
Contrast Ratio	600 : 1	
Pixel Pitch (mm)	0.207(H) x 0.207(V)	
Viewing Angle	160°(H), 140°(V)	
Display Colors	16.2M colors	
Response Time (Typical)	25ms (Typical)	
Power Input	DC 12V	
Power Consumption	5W	
Dimensions (mm)	172.2x101x33.5mm	172.2x165.2x33.5mm
Weight (Net)	0.38Kg	0.42Kg

1.3 ABSOLUTE MAXIMUM RATINGS

TFT LCD Module

Item	Symbo	Min	Max	Unit	Remark
Logic/LCD Drive Voltage	VDD	-0.3	+4.0	Volt	Ta= 25°C
LCD Input Signal Voltage	VIN	-0.3	+4.0	Volt	Ta= 25°C
LED BLU Drive Voltage	V_{LED}	0	25	Volt	Ta= 25°C
LED Dimming Input Voltage	V_{PWM}	0	6	Volt	Ta= 25°C

ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Min	Max	Unit	Remark
Operating Temperature	TOP	-30	+80*	℃	Note 1, 2
Operation Humidity	HOP	5	95	%RH	Note 1, 2
Storage Temperature	TST	-30	+80*	℃	Note 1
Storage Humidity	HST	5	95	%RH	Note 1

Note 1: Maximum Wet-Bulb should be 39□ and no condensation.

Note 2: Only operation is guaranteed. Optical and display performance should be evaluated at 25□ only.

*: Panel surface temperature

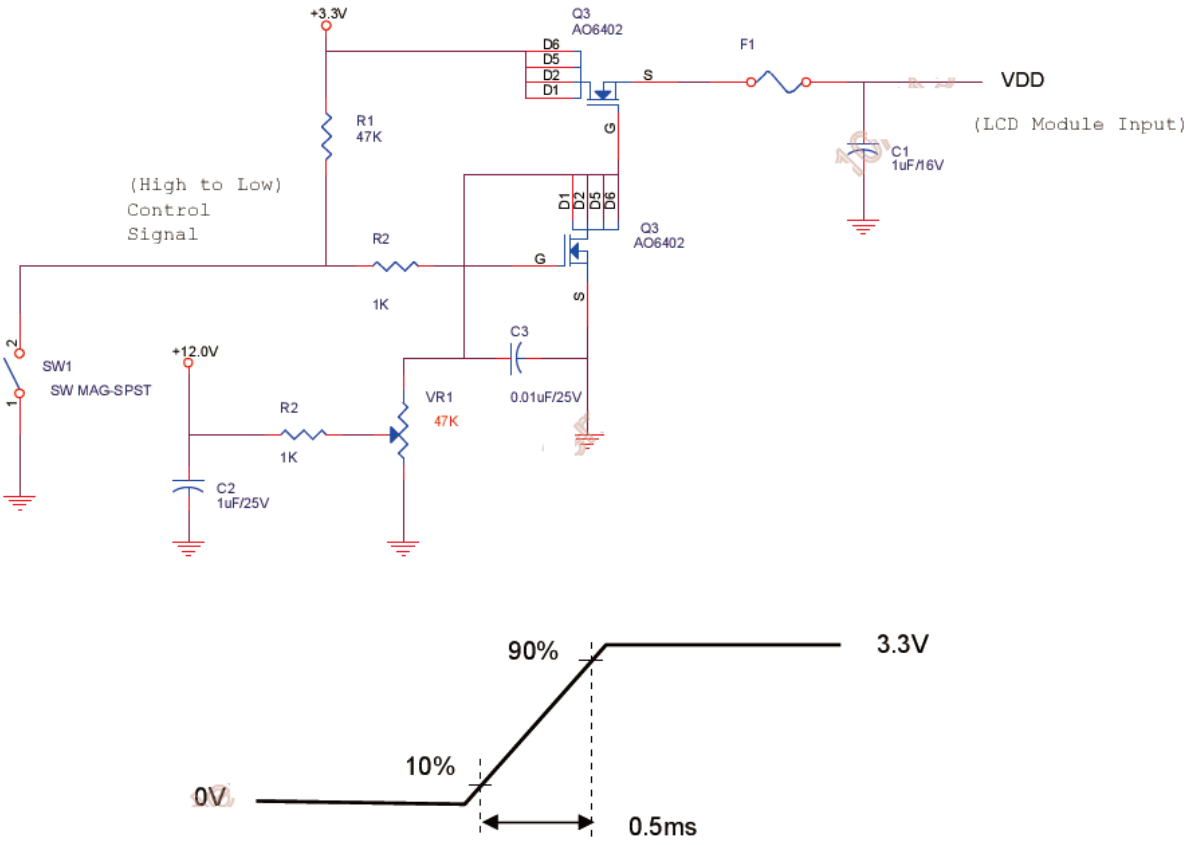
2.0 Electrical characteristics

TFT LCD Module Power Specification

Input power specifications are as following:

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	Volt	
IDD	VDD Current	-	260		mA	All Black Pattern (VDD=3.3V, at 60Hz)
Irush	LCD Inrush Current	-	-	1.5	A	Note 1
PDD	VDD Power	-	0.86		Watt	All Black Pattern (VDD=3.3V, at 60Hz)
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	mVp-p	All Black Pattern (VDD=3.3V, at 60Hz)

Note 1: Measurement Condition



3.0 SIGNAL Characteristic

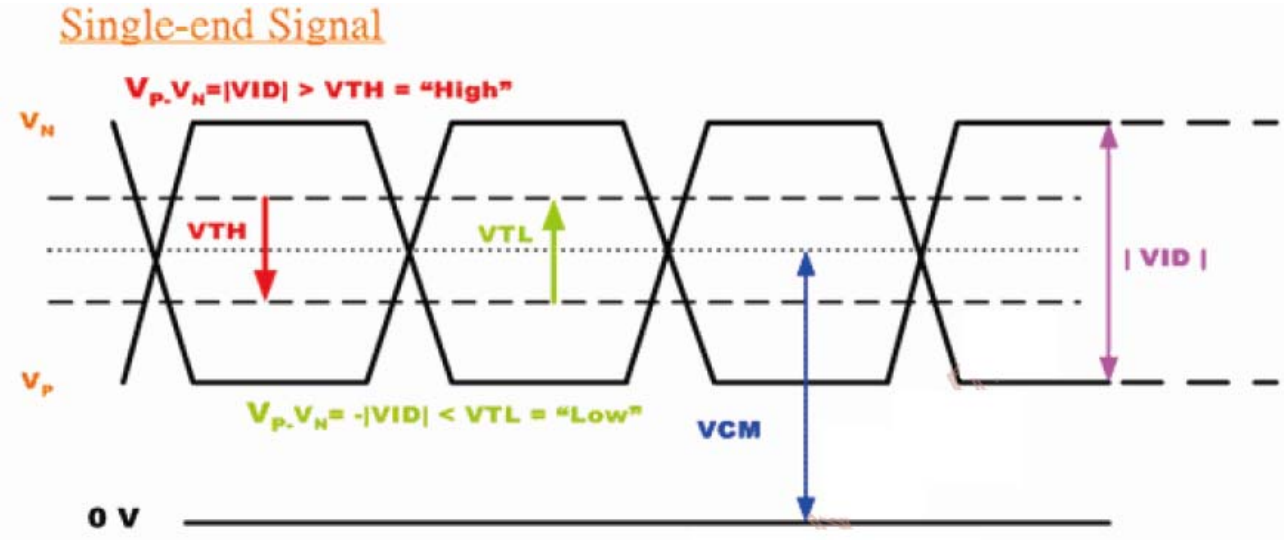
Input Signals should be low or Hi-Z state when VDD is off.

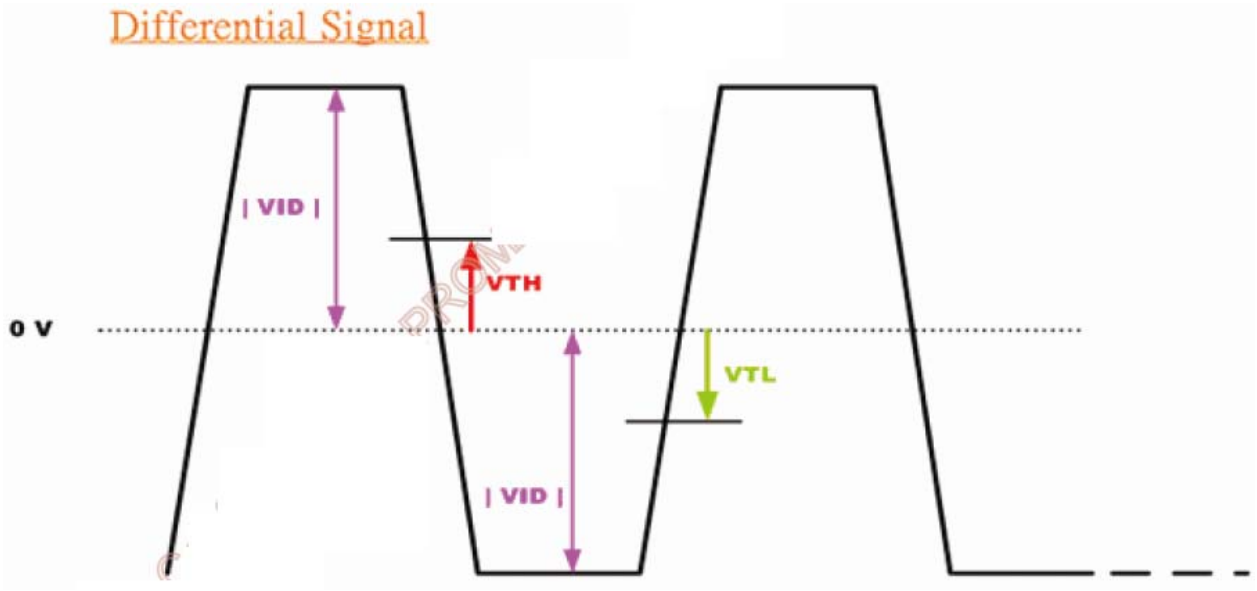
LVDS signal

LVDS Transmitter: THC63LVDM83A (THINE) or equivalent

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Differential Input High Threshold	VTH	-	-	100	mV	VCM=1.20V
Differential Input Low Threshold	VTL	-100	-	-	mV	VCM=1.20V
Input Differential Voltage	| VID |	100	400	600	mV	
Differential Input Common Mode Voltage	VCM	1.1	-	1.45	V	VTH, VTL= ±100mV

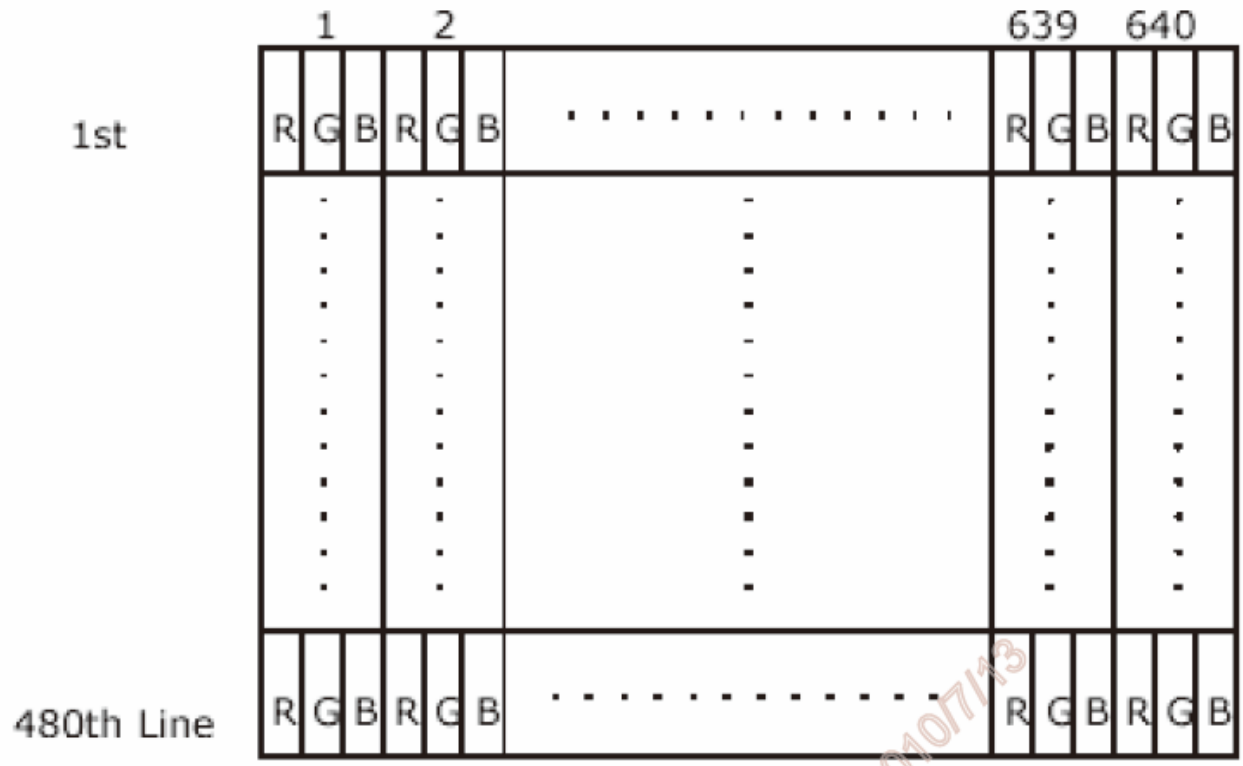
Note 1: LVDS Signal Waveform.





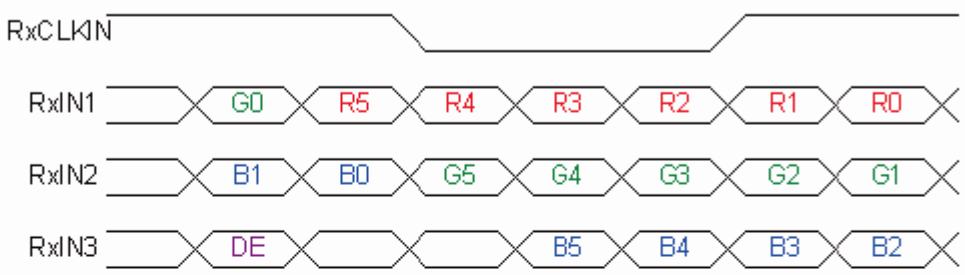
Pixel Format Image

Following picture shows the relationship between the input signal and LCD pixel format.

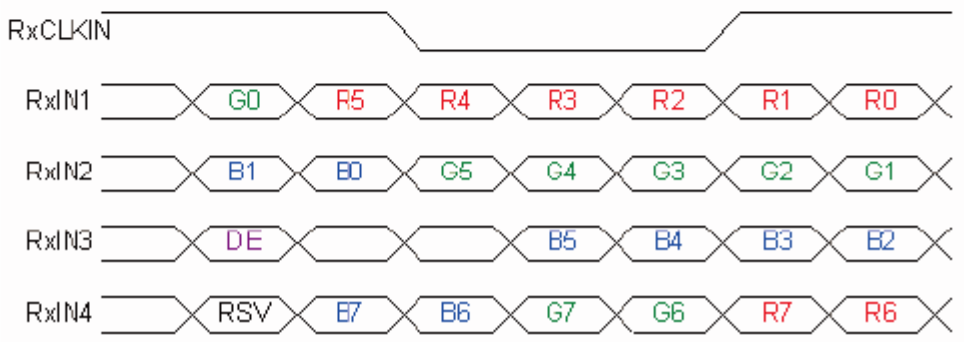


The Input Date Format

SEL68 = "Low" or "NC" for 6 bits LVDS Input



SEL68 = "High" for 8 bits LVDS Input



Signal Name	Description	Remark
R7	Red Data 7	Red-pixel Data
R6	Red Data 6	
R5	Red Data 5	For 8Bits LVDS input
R4	Red Data 4	MSB: R7 ; LSB: R0
R3	Red Data 3	
R2	Red Data 2	For 6Bits LVDS input
R1	Red Data 1	MSB: R5 ; LSB: R0
R0	Red Data 0	
G7	Green Data 7	Green-pixel Data
G6	Green Data 6	
G5	Green Data 5	For 8Bits LVDS input
G4	Green Data 4	MSB: G7 ; LSB: G0
G3	Green Data 3	
G2	Green Data 2	For 6Bits LVDS input
G1	Green Data 1	MSB: G5 ; LSB: G0
G0	Green Data 0	
B7	Blue Data 7	Blue-pixel Data
B6	Blue Data 6	
B5	Blue Data 5	For 8Bits LVDS input
B4	Blue Data 4	MSB: B7 ; LSB: B0
B3	Blue Data 3	
B2	Blue Data 2	For 6Bits LVDS input
B1	Blue Data 1	MSB: B5 ; LSB: B0
B0	Blue Data 0	
RxCLKIN	LVDS Data Clock	
DE	Data Enable Signal	When the signal is high, the pixel data shall be valid to be displayed.
RSV	Reserved Signal	"High" or "Low" is acceptable

Note 1: Output signals from any system shall be low or Hi-Z state when VDD is off.

TFT-LCD Interface Signal Description

LVDS is a differential signal technology for high-speed data transfer LCD interface. LVDS Transmitter shall be THC63LVDM83A (THINE) or equivalent.

Pin No.	Symbol	Pin Description
1	VDD	Power supply, 3.3V (typical)
2	VDD	Power supply, 3.3V (typical)
3	GND	Ground
4	SEL68	Selection for either 6bit or 8bit LVDS input: SEL68 ="Low" or "NC", accepts 6bit LVDS data input; SEL68 = "High", accepts 8bit LVDS data input.
5	RxIN1-	Negative LVDS differential input (R0-R5, G0)
6	RxIN1+	Positive LVDS differential input (R0-R5, G0)
7	GND	Ground
8	RxIN2-	Negative LVDS differential input (G1-G5, B0-B1)
9	RxIN2+	Positive LVDS differential input (G1-G5, B0-B1)
10	GND	Ground
11	RxIN3-	Negative LVDS differential input (B2-B5, DE)
12	RxIN3+	Positive LVDS differential input (B2-B5, DE)
13	GND	Ground
14	RxCLKIN-	Negative LVDS differential clock input
15	RxCLKIN+	Positive LVDS differential clock input
16	NC	No connection
17	U/D	Vertical Reverse ("L" or NC: Normal, "H": Reverse)
18	R/L	Horizontal Reverse ("L" or NC: Normal, "H": Reverse)
19	RxIN4-	Negative LVDS differential input (R6-R7, G6-G7, B6-B7) NC for 6bit LVDS input.
20	RxIN4+	Positive LVDS differential input (R6-R7, G6-G7, B6-B7) NC for 6bit LVDS input.

Note 1: "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connection".

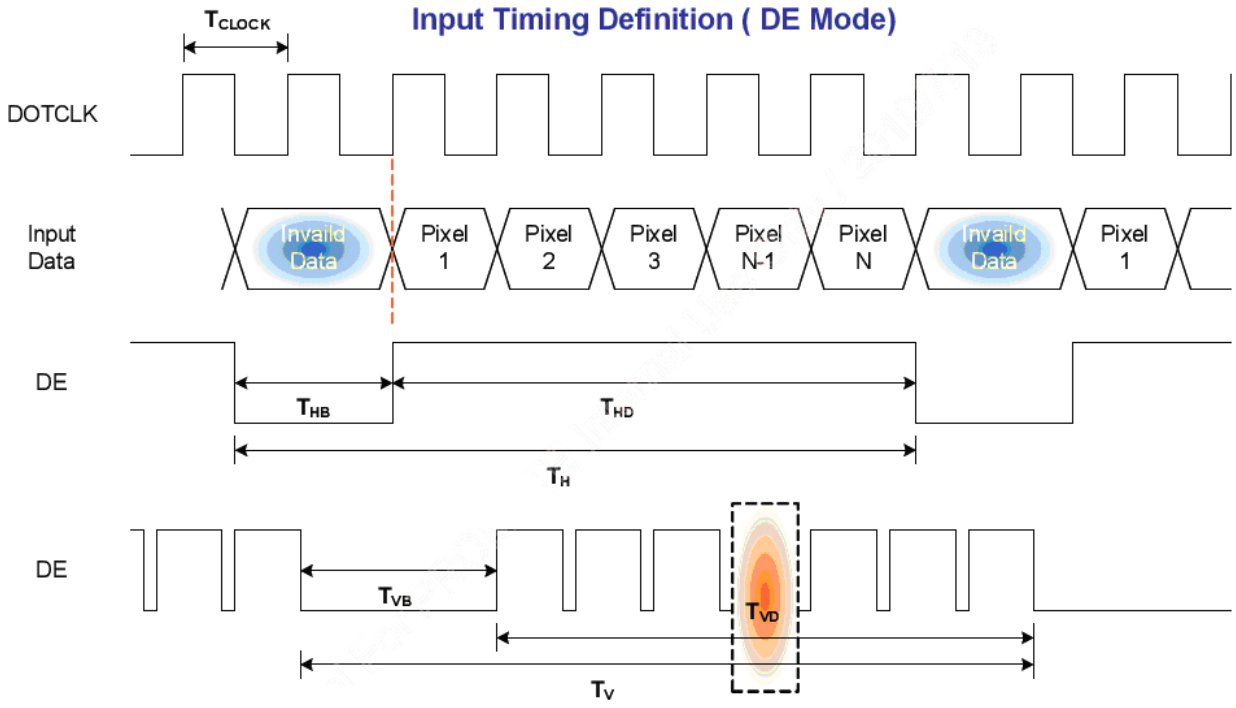
4.0 TIMING Characteristics

DE mode only

Signal		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock frequency (DOTCLK)		$1/T_{CLOCK}$	20	25.2	50	MHz	Note1
Horizontal Section	Period	T_H	770	800	1070	T_{CLOCK}	Note1
	Active	T_{HD}		640			
	Blanking	T_{HB}	130	160	430		
Vertical Section	Period	T_V	520	525	622	T_{LINE}	Note1
	Active	T_{VD}		480			
	Blanking	T_{VB}	40	45	142		

Note 1: Recommended frame rate is 60 Hz.

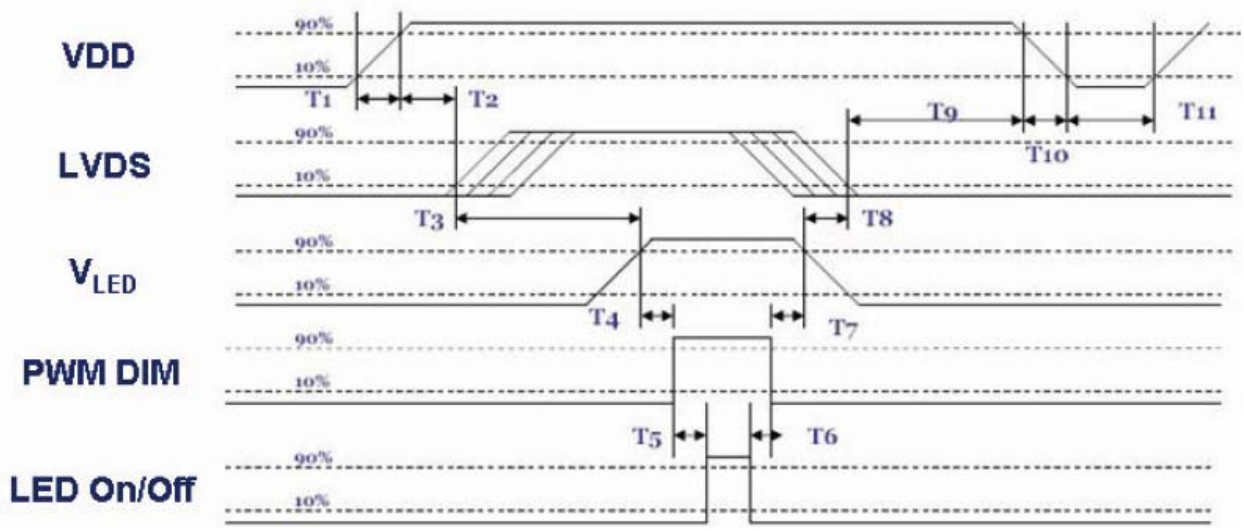
Input Timing diagram



Power ON/OFF Sequence

VDD power, LCD interface signals and backlight on/off sequence are shown in the following chart.

Signals from any system shall be Hi-Z state or low level when VDD is off.



Power ON/OFF sequence timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	ms
T2	30	40	50	ms
T3	200	-	-	ms
T4	10	-	-	ms
T5	10	-	-	ms
T6	0	-	-	ms
T7	10	-	-	ms
T8	100	-	-	ms
T9	0	16	50	ms
T10	-	-	10	ms
T11	1000	-	-	ms

ON/OFF sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

5.0 CONNECTOR and PIN ASSIGNMENT

TFT LCD Connector & Pin Assignment

Manufacturer	STM
Connector Model Number	MSB24013P20, compatible with I-PEX 20268-020E
Mating Connecter Model Number	Hirose DF19 -20S-1C or compatible

Pin#	Symbol	Pin#	Symbol
1	VDD	11	RxIN3-
2	VDD	12	RxIN3+
3	GND	13	GND
4	SEL68	14	RxCLKIN-
5	RxIN1-	15	RxCLKIN+
6	RxIN1+	16	NC
7	GND	17	U/D
8	RxIN2-	18	R/L
9	RxIN2+	19	RxIN4-
10	GND	20	RxIN4+

Backlight Connector & Pin Assignment

Manufacturer	STM
Connector Model Number	MS24016RHD, compatible with MOLEX 53261-0671
Mating Connecter Model Number	STM P24016 or compatible

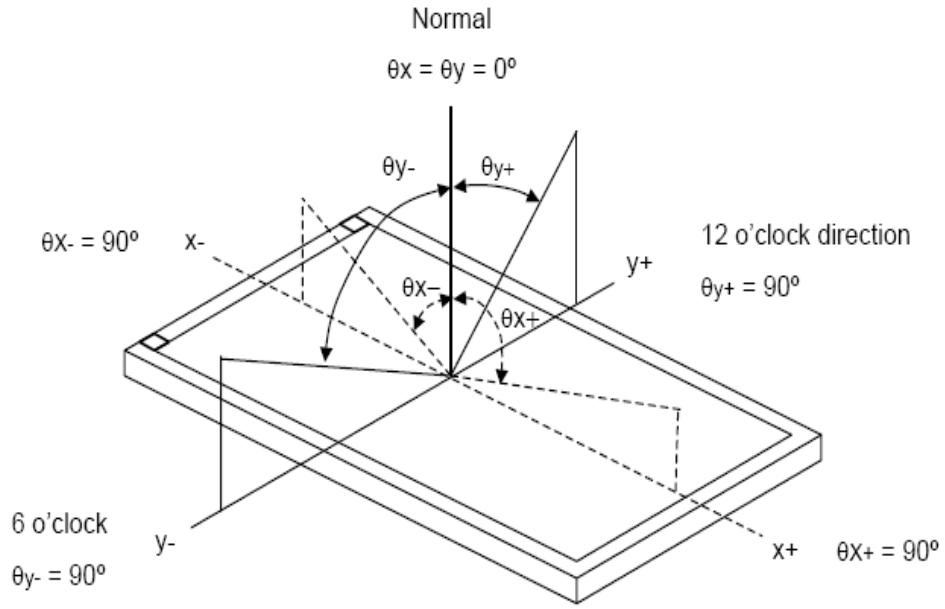
Pin #	Symbol	Pin #	Symbol
1	V_{LED}	4	GND
2	V_{LED}	5	LED ON/OFF
3	GND	6	PWM DIM

6.0 OPTICAL SPECIFICATION

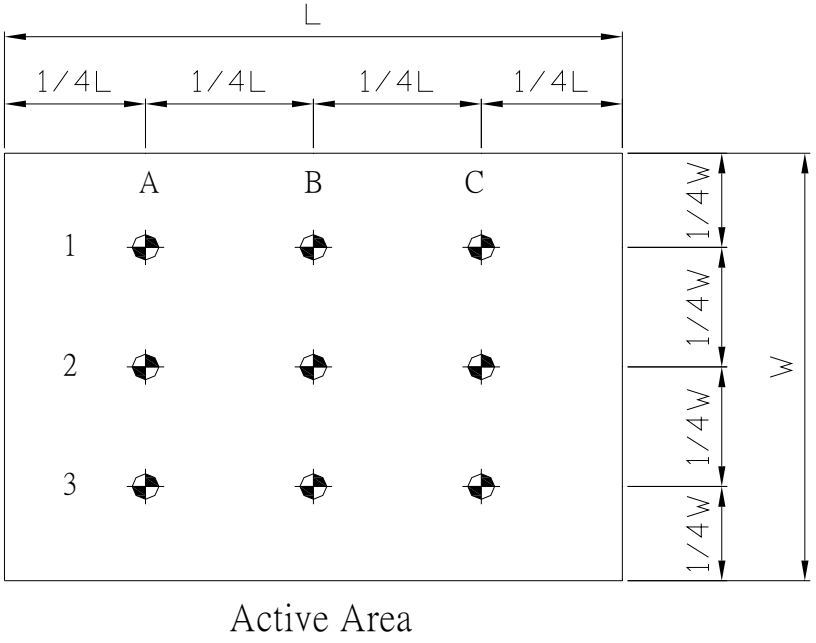
Item		Symbol	Condition	Data	Unit	Note
Color chromaticity	Red	Rx	θx=0 θy=0 BM-7	0.599	-	Test Mode：(1)(2)(3)
		Ry		0.379	-	
	Green	Gx		0.325	-	
		Gy		0.605	-	
	Blue	Bx		0.145	-	
		By		0.114	-	
	White	Wx		0.311	-	
		Wy		0.349	-	
Center Luminance of White		Lc		1000±10%	cd/㎡	
Average		La		950	cd/㎡	
Uniform		Lu		75±5	%	
Contrast Ratio		CR	θx=0 θy=0 Klein K-10	600	-	Test Mode：(1)(4)
Color Saturation		NTSC		55	%	
Viewing Angle	Horizontal	θx+	CR≧10	80	Deg	Test Mode：(1)(3)
		θx-		80		
	Vertical	θy+		70		
		θy-		70		

Test Mode：

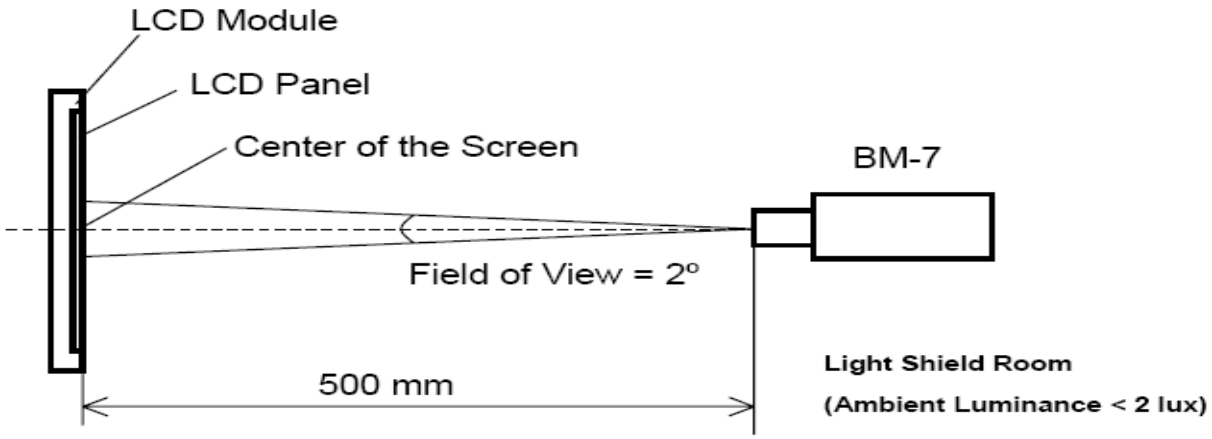
（1） Definition of Viewing Angle（θx，θy）：



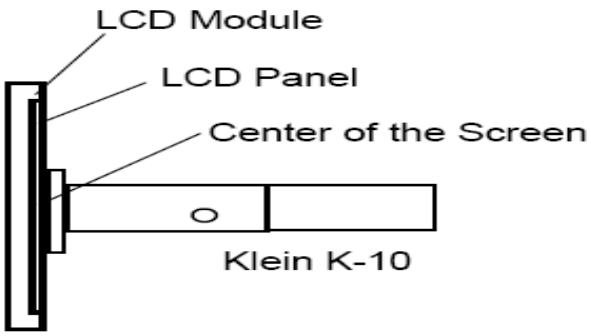
（**2**） Definition of Test Point：



（**3**）**BM-7** Measurement Setup**:**



（**4**）**Klein K-10** Measurement Setup**:**



7.0 LED Backlight Unit Driving

1. Parameter guideline for LED driving

Following characteristics are measured under stable condition at 25 degree C (room temperature).

Symbol	Parameter	Min	Typ	Max	Units	Remark
V_{LED}	Input Voltage	9	12	20	Volt	
I_{LED}	Input Current	-	0.25		A	100% PWM duty
P_{LED}	Power Consumption	-	3.0		W	100% PWM duty
$Irush_{LED}$	Inrush Current	-	**0.37**	**0.41**	A	100% PWM duty
$V_{LED\ On/Off}$	On Control Voltage		3.3		Volt	
	Off Control Voltage		0		Volt	
V_{PWM}	Dimming control Voltage High	3.0	3.3	5.5	Volt	
	Dimming control Voltage Low	0		0.1	Volt	
F_{PWM}	Dimming Frequency	200		30K	Hz	
D_{PWM}	Dimming duty cycle	1		100	%	
Operating Life		50000			Hrs	Note 2, 3

Note 1: See Section 6.6 for LED Backlight Unit Interface Signal Description.

Note 2: If G065VN01 V2 module is driven at high ambient temperature & humidity condition. The operating life will be reduced.

Note 3: Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

2016/7/13

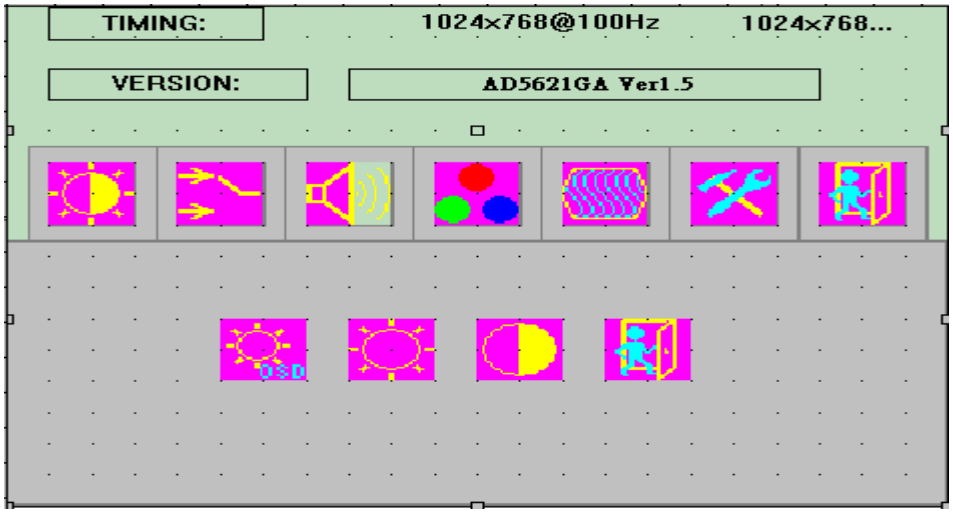
LED Backlight Unit Interface Signal Description

Pin #	Symbol	Pin Description
1	V_{LED}	12V input
2	V_{LED}	12V input
3	GND	Ground
4	GND	Ground
5	LED On/Off	3.3V-On; 0V/NC-Off
6	PWM DIM	1~100%

Note1: “NC stands for “No Connection””.

8.0 OSD Manual

Here are some instructions for you to use the OSD (On Screen Display). By pressing the “menu”, you will see the below picture.
Timing shows resolution, H-frequency ,and V-frequency of the panel.Version shows the firmware control version. This 2 information is not changeable by user.



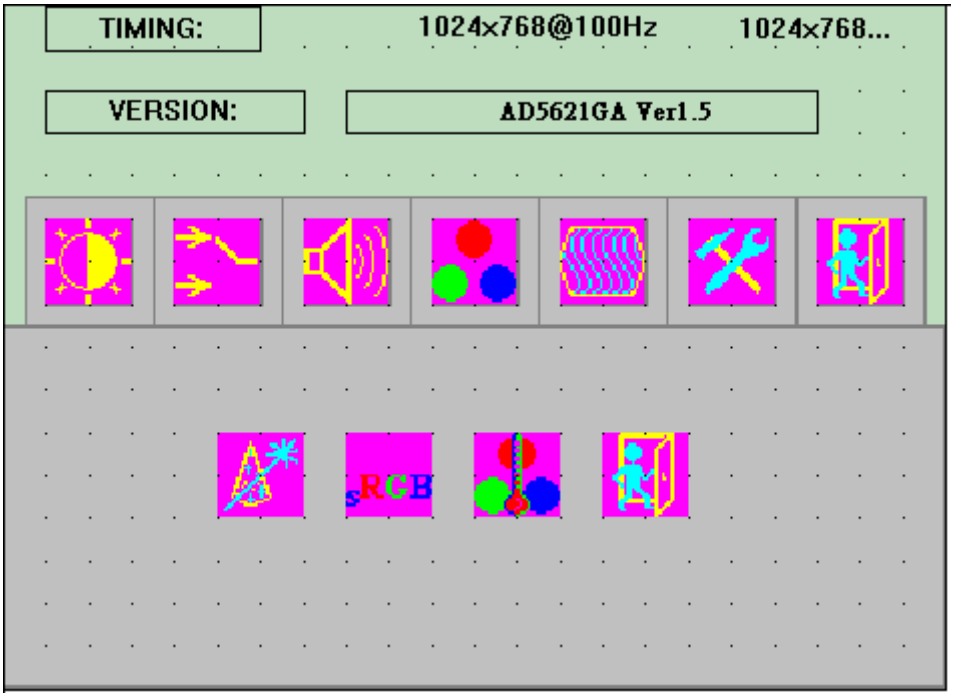
OSD Brightness:

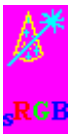
press ’’right’’ key

press “menu” once, you can go into adjust the brightness. Press “left” you can dim down the brightness to “0”, while press “right” you can increase the brightness to “100”.

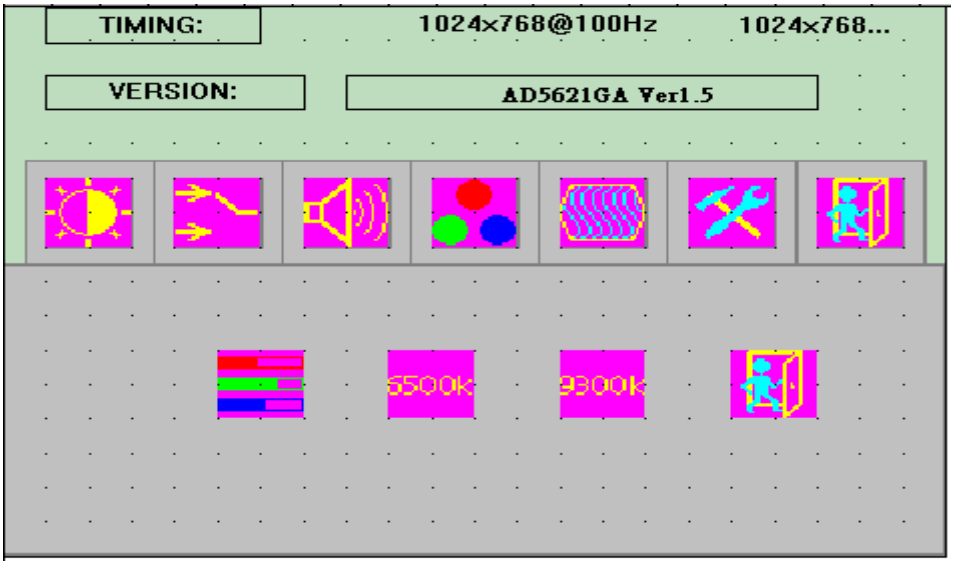
Contrast: Press “menu” and “right” you can adjust the contrast from “0” to “100” by pressing the “left” and “right”.

Exit: You can exit this sub menu back to normal screen.





Auto Color: by press this “Auto Color” option, you can get the optimal color performance.
SRGB: Windows standard color setting.



Color Tempture: You can have 3 options in this selection.

Color Tempture User

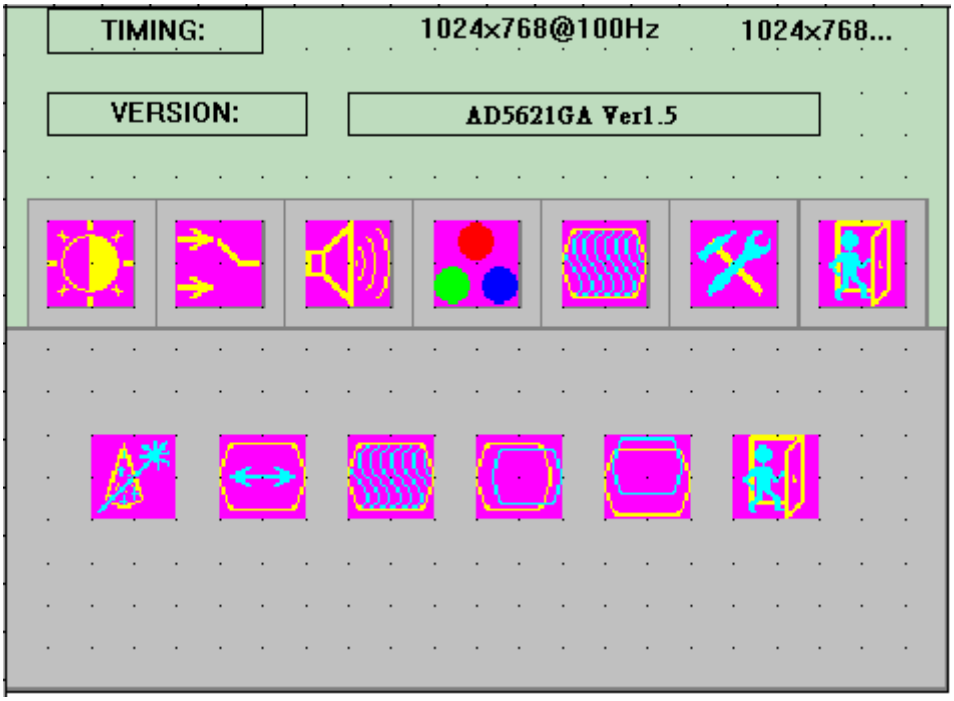
Color Tempture_6500K

Color Tempture_93OOK

“user mode”, “6500K” (Warm color scheme), “9300K (Cold color scheme).
Def ault is “user”, and inside all “R”, “G”, and “B” are set “100”

Exit: back to the normal screen.

Go into the “Image” page, you can see below picture.



Auto just: Pressing this option, the AD5621 will adjust the optimal frequency of horizontal and vertical. You will see “Auto tune….” On the screen for around 3 seconds.

Clock: If you are not satisfied about the Autotune result, you can adjust manually by “Clock”.
The screen will be “wider” if you adjust this function.

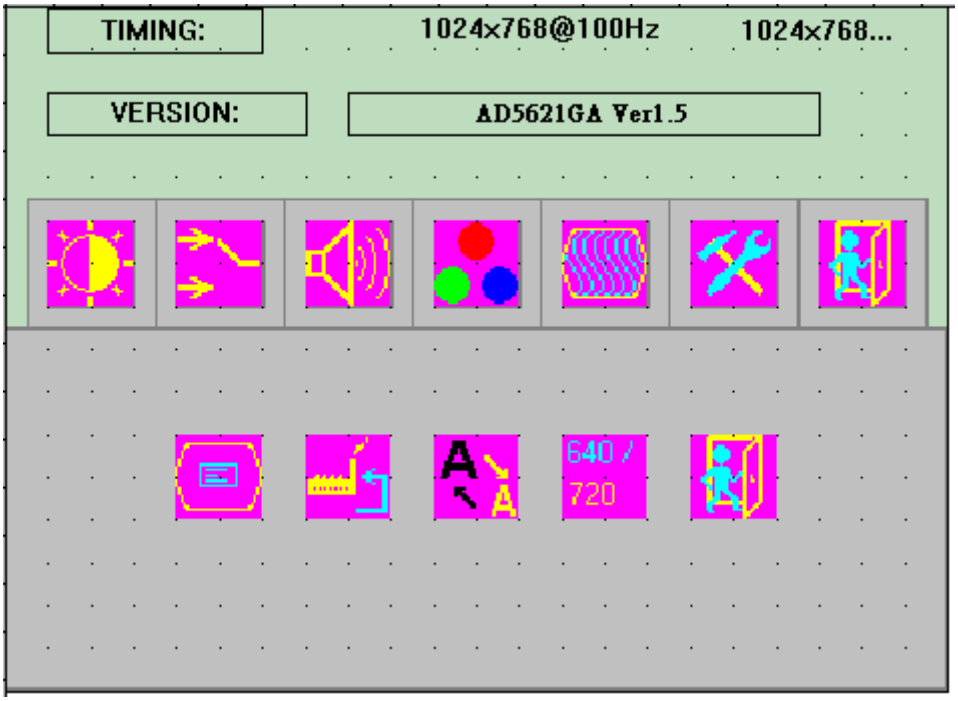
Phase: If you see “double image” on characters, you can adjust “Phase” to make it perfect image.

HPos: You can shift the screen horizontally by this function.

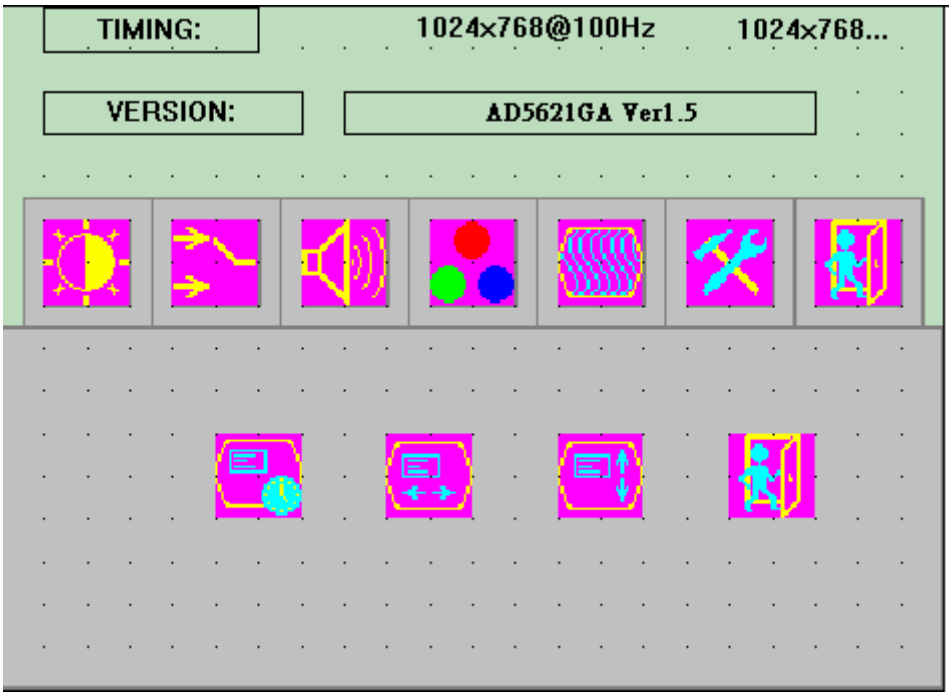
Vpos: You can shift the screen vertically by this function.

Exit: Back to normal screen.

On the “Tools” sub menu, you will see 5 icons.



OSD Control: Select this option, you will see 4 more options:



Osd_time: You can selection the time of OSD from 2 sec. to 16 sec. D

Osd_HPos: You can move the OSD horizontally over the screen.

Osd_VPos: You can move the OSD Vertically over the screen.

Exit: back to main menu.

Factory_Reset: By pressing this, the screen will be back to the factory setting on very beginning and lost all the personal settings.

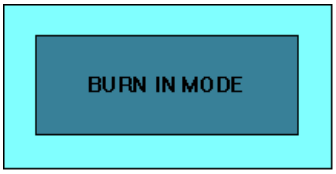
Sharpness: You can make the characters looks sharper.

Dos_mode/Gxf_mode: Some old programs running over 640x400 and 720x400 (DOS Mode and graphics mode), you need to select this option manually.

Exit

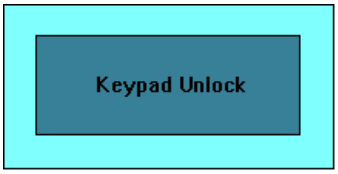
Factory Burn-in mode: While your VGA cable is connected on the monitor, press “Menu” and Left <” simultaneously, you will see “BURN IN MODE” on the center of the screen for 3 sec. Then unplug the VGA cable, the screen will show Red, Green, Blue, White, and Black in sequence automatically.

You can plug in the VGA signal cable, and re-plug the power connector to exit the burn-in mode.



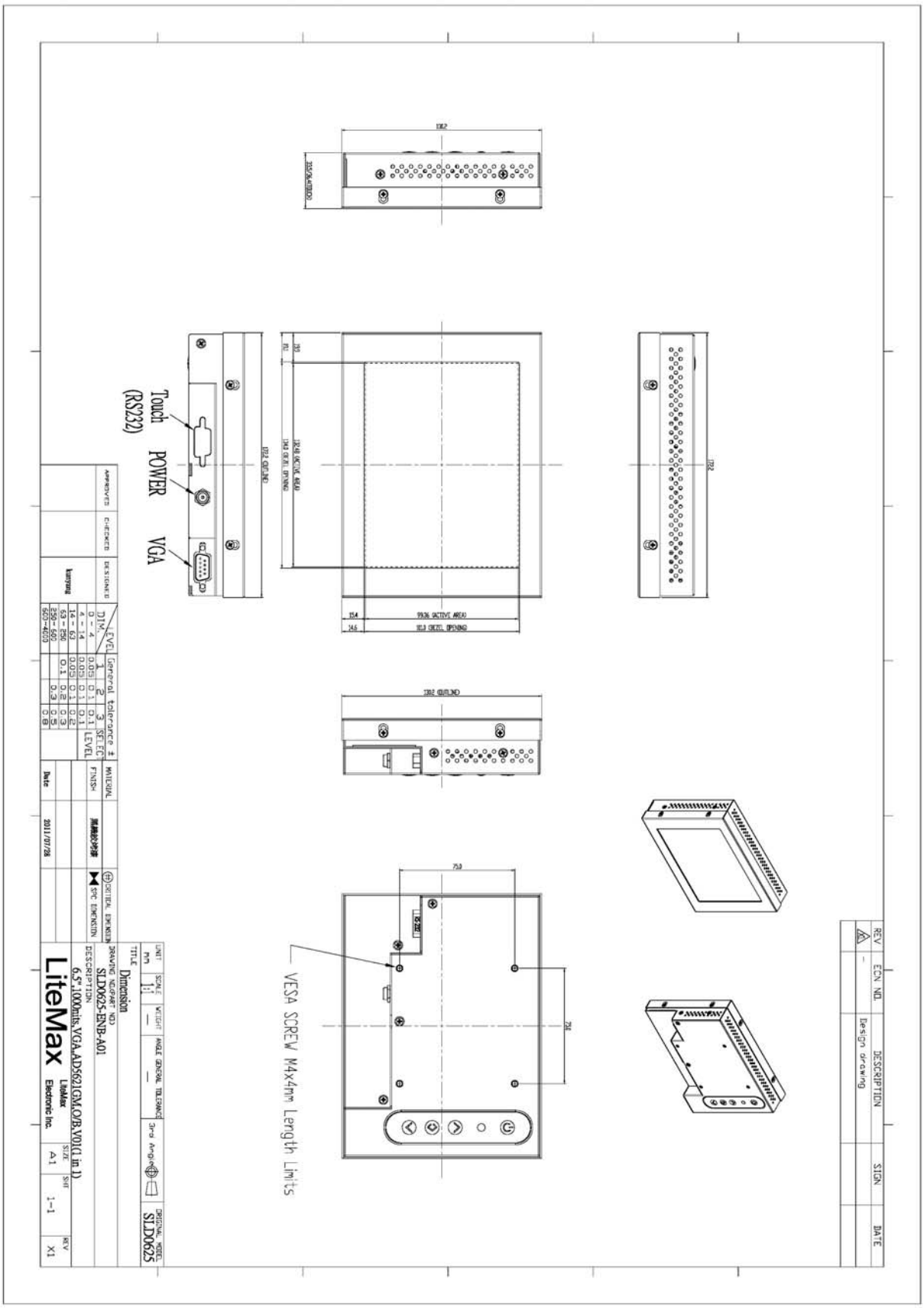
OSD Lock Function: It is possible to lock all the OSD buttons to prevent unauthorized changes to occur by pressing “Menu” and “right >” buttons simultaneously. You will see the “lock” icon below on the center of the screen for 3 seconds. If any button is pushed after the lock function is initiated, the below icon will appear on the screen.'

To release the OSD lock, press “Menu” and “Right >”. The below icon will appear on the center of the screen for 3 seconds. Now all OSD keys are active again.

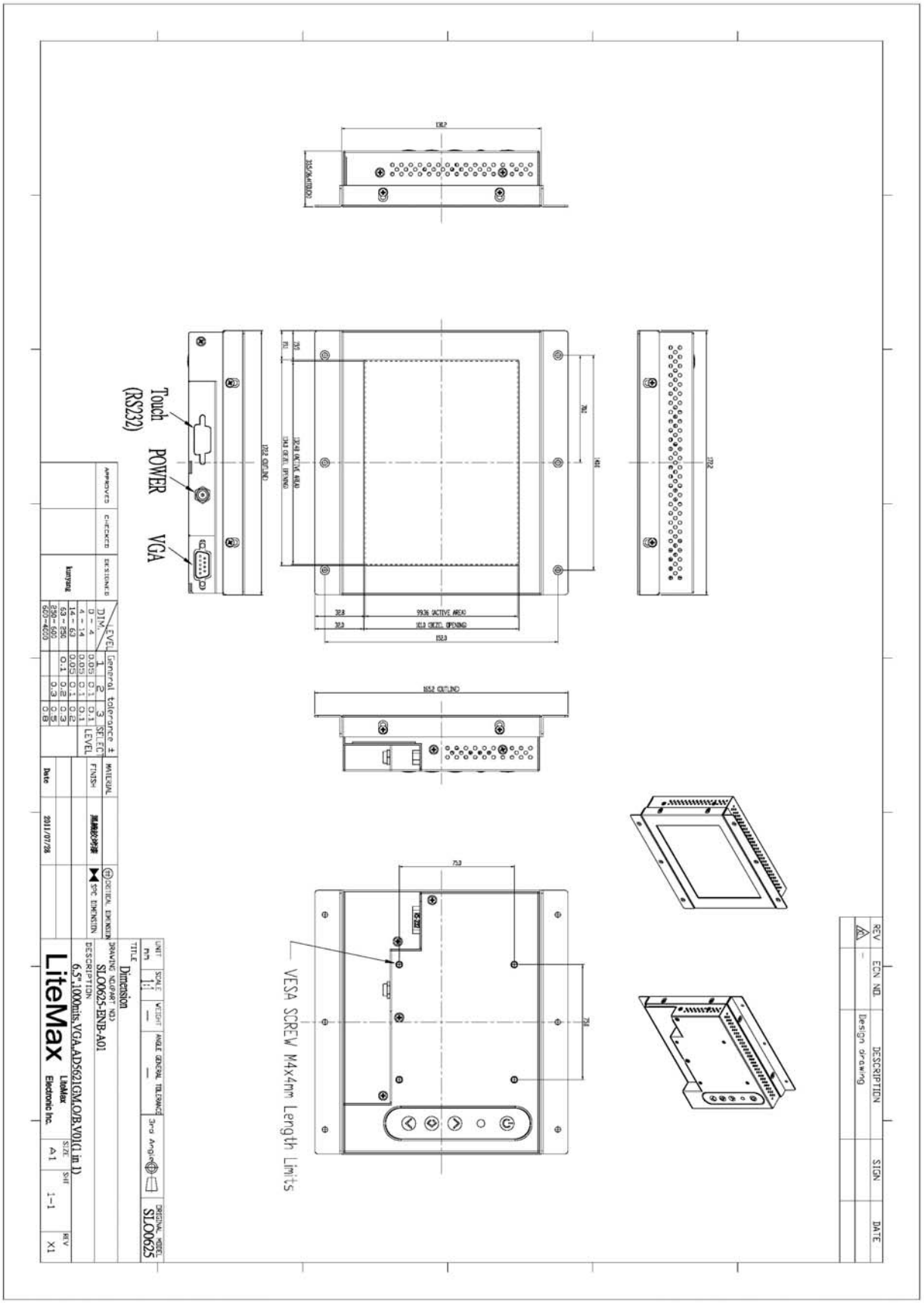


9.0 MECHANICAL DRAWING

SLD0625



SLO0625


Touch (RS232)
POWER
VGA
VESA SCREW M4x4mm Length Limits
Design drawing
LiteMax
Electronic Inc.
6.5" 1000nits VGA AD5621GM.O/BV0(1 in 1)
SLO0625-ENB-A01
Dimension
SLO0625

10.0 PRECAUTIONS

HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
(9) Do not disassemble the module.
(10) Do not pull or fold the lamp wire.
(11) Pins of I/F connector should not be touched directly with bare hands.

STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

OPERATION PRECAUTIONS

(1) Do not pull the I/F connector in or out while the module is operating.
(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.